SIEMENS

PATENT
Attorney Docket No. 2002P12570WOUS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Inventor:	T. Bosselmann et al.	Group Art Unit: 2831
Serial No.:	10/533,014	Examiner: Thomas F. Valone
Filed:	April 28, 2005	Confirmation No. 1667

Title: TURBO ENGINE WITH CONDITION MEASURING ELEMENT

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Sir:

APPELLANT'S BRIEF UNDER 37 CFR 41.37

This brief is in furtherance of the Notice of Appeal filed in this application on October 08, 2008.

1. REAL PARTY IN INTEREST - 37 CFR 41.37(c)(1)(i)

The real party in interest in this Appeal is the assignee of the present application, Siemens Aktiengesellschaft.

2. RELATED APPEALS AND INTERFERENCES - 37 CFR 41.37(c)(1)(ii)

To the best of our knowledge, there is no other appeal, interference or judicial proceeding that is related to or that will directly affect, or that will be directly affected by, or that will have a bearing on the Board's decision in this Appeal.

3. STATUS OF CLAIMS - 37 CFR 41.37(c)(1)(iii)

Claims pending: Claims 21-25 and 27-41.

Claims cancelled: 1-20 and 26.

Claims withdrawn but not cancelled: none

Claims allowed: none

Claims rejected: 21-25 and 27-41.

Claims on appeal: 21-25 and 27-41.

4. STATUS OF AMENDMENTS - 37 CFR 41.37(c)(1)(iv)

The response filed under 37 CFR 1.116 that included no claim amendment has been entered.

5. SUMMARY OF THE CLAIMED SUBJECT MATTER- 37 CFR 41.37(c)(1)(v)

Independent claim 21 is directed to a turbo engine including a plurality of rotor blades 4 (FIG. 4 or 5) made of an electrically conducting material having an electrically insulating surface. See page 9, lines 1-3 of paragraph 39 of the disclosure (Substitute Specification) of the present invention. The blades are arranged on a rotor shaft 3 that is rotatably mounted in a housing and is electrically connected to a reference potential or on a plurality of fixed guide vanes 7 made of an electrically conducting material having an electrically insulating surface with the electrically conducting material of the guide vanes electrically connected to the reference potential. See page 10, lines 1-3 of paragraph 42 of the disclosure. A measuring element (e.g., coax antenna 6, as shown in FIGS. 4 and 5; or induction sensor 9, as shown in FIG. 5) operating in a kilohertz frequency range is used for measuring an electric or magnetic field strength set up by a charge distribution on the electrically insulating surface of the rotor blades or guide vanes and for generating a signal indicative of the electric or magnetic field strength. See page 10, lines 4-9 of paragraph 43 of the disclosure. See also page 11, lines 3-7 of paragraph 46 of the

disclosure and pages 3-4, from first to last line of paragraph 10 of the disclosure. The strength of the electric or magnetic field is indicative of a level of wear or a defect that can arise in the electrically insulating surface. See page 11, lines 1-10 of paragraph 45 of the disclosure. The measuring element is arranged near a radially disposed row of the rotor blades or near a radially disposed row of the guide vanes. The frequency range is based on a rotational speed of the turbo engine and the number of rotor blades per row or the number of guide vanes per row. See page 10, last 4 lines of paragraph 43 of the disclosure. A monitoring unit 11 is used for determining when the signal deviates from a threshold being defined responsive to at least one of a load condition of the turbo engine and a location of the rotor blades or the guide vanes relative to an outlet of the turbo engine. See page 12, lines 1-7 of paragraph 50 of the disclosure.

Independent claim 32 is directed to a method for determining damage to an electrically insulating surface of a turbine component. The method allows providing a plurality of turbine blades 4 or vanes 7 (FIG. 4 or 5) made of an electrically conducting material and arranged within a turbo engine. An electric or magnetic field strength is created by a charge distribution on the electrically insulating surface of the turbine blade or vane. See pages 3-4, from first to last line of paragraph 10 of the disclosure. The electric or magnetic field strength is measured by a measuring element (e.g., coax antenna 6, as shown in FIGS. 4 and 5; or induction sensor 9, as shown in FIG. 5) operating in a kilohertz frequency range. See page 10, lines 4-9 of paragraph 43 of the disclosure. See also page 11, lines 3-7 of paragraph 46 of the disclosure. The strength of the electric or magnetic field is indicative of a level of wear or a defect that can arise in the electrically insulating surface. See page 11, lines 1-10 of paragraph 45 of the disclosure. The measuring element is positioned near a radially disposed row of the rotor blades or near a radially disposed row of the guide vanes. The frequency range is based on a rotational speed of the turbo engine and the number of rotor blades per row or the number of guide vanes per row. See page 10, last 4 lines of paragraph 43 of the disclosure. A threshold is defined to be responsive to at least one of a load condition of the turbo engine and a location of the rotor blades or the guide vanes relative to an outlet of the turbo engine. A determination is made of when the electric or magnetic field strength deviates from the threshold. See page 12, lines 1-7 of paragraph 50 of the disclosure.

Independent claim 41 is directed to a turbo engine including a plurality of rotor blades 4 (FIG. 4 or 5) made of an electrically conducting material having an electrically insulating

surface. See page 9, lines 1-3 of paragraph 39 of the disclosure of the present invention. The blades are arranged on a rotor shaft that is rotatably mounted in a housing and electrically connected to a reference potential or a plurality of fixed guide vanes made of an electrically conducting material having an electrically insulating surface with the electrically conducting material of the guide vanes electrically connected to the reference potential. See page 10, lines 1-3 of paragraph 42 of the disclosure. A measuring element (e.g., coax antenna 6, as shown in FIGS. 4 and 5; or induction sensor 9, as shown in FIG. 5) operating in a kilohertz frequency range is used for measuring an electric or magnetic field strength set up by a charge distribution on the electrically insulating surface of the rotor blades or guide vanes and for generating a signal indicative of the electric or magnetic field strength. See page 10, lines 4-9 of paragraph 43 of the disclosure. See also page 11, lines 3-7 of paragraph 46 of the disclosure. The strength of the electric or magnetic field is indicative of a level of wear or a defect that can arise in the electrically insulating surface. See page 11, lines 1-10 of paragraph 45 of the disclosure. The measuring element is arranged near a radially disposed row of the rotor blades or near a radially disposed row of the guide vanes. The frequency range is based on a rotational speed of the turbo engine and the number of rotor blades per row or the number of guide vanes per row. See page 10, last 4 lines of paragraph 43 of the disclosure. A monitoring unit 11 is used for determining when the signal deviates from a threshold being defined responsive to a load condition of the turbo engine. See page 12, lines 1-7 of paragraph 50 of the disclosure.

6. GROUNDS OF REJECTION TO BE REVIEWED UPON APPEAL - 37 CFR 41.37(c)(1)(vi)

A) Whether claims 21-25, 27-36 and 41 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 4,804,905 (hereinafter "Ding") in view of U.S. Patent 5,514,482 (hereinafter "Strangman") and further in view of US patent no. 5,552,711 (hereinafter "Deegan").

B) Whether claims 37-40 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Ding, Strangman, Deegan and further in view of I.E.E.E. Interharmonic Task Force Publication titled "*Interharmonics in Power Systems*".

7. ARGUMENT 37 CFR 41.37(c)(1)(vii)

A. *Regarding the rejection of claims 21-25, 27-36 and 41 under 35 U.S.C. 103(a) as being unpatentable over Ding in view of Strangman and further in view of Deegan.*

Appellant argues that the Ding/Strangman/Deegan combination does not constitute an appropriate *prima facie* combination for renderings claims 21-25, 27-36 and 41 unpatentable, at least under two distinct basis of traversal, as discussed in greater detail below. With regard to the claim rejections, it is appellant's belief that not all of the rejected claims stand or fall together. More specifically, independent claim 21 and dependent claims stand together. However, claims 32 and 41, distinct independent claims, (and claims depending there from) should be grouped separately for purposes of this appeal.

M.P.E.P. 2143.04 provides that to establish *prima facie* obviousness of a claimed invention, all the claims limitations must be taught or suggested by the prior art. All words in a claim must be considered for judging the patentability of the claim against the prior art. If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending there from is nonobvious.

The primary reference (Ding) fails to teach or suggest a turbo engine that includes a measuring element for measuring an electric or magnetic field strength set up by a charge distribution on the electrically insulating surface of the rotor blades or guide vanes, where the strength of the electric or magnetic field obtained by the measuring element is indicative of a level of wear or a defect that can arise in the electrically insulating surface.

One skilled in the art would appreciate that Ding has virtually nothing to do with the problem being solved by the structural and/or operational relationships of the presently claimed invention. Ding is directed to a capacitance measuring system for measuring the distance (i.e., gap) between two relatively movable parts, such as the gap S between rotor blades 4 and casing 2. See FIG. 5 of Ding. See also the first six lines of the abstract and title of Ding.

Ding expressly describes at col. 4, lines 24-40 that the maximum charge Qimax for each blade passage varies with the capacitance of a so-called gap capacitor Csi and thus with the

distance s of the individual blade 4 from the sensor in accordance with the equation below:

$$Qi_{max} = C_{si} \times U_{ref} \times f(s)$$

where Uref represents a bias voltage for the gap capacitor, Csi represents the capacitance of the gap capacitor and f(s) represents a relationship between gap and capacitance as determined by calibration. The so-called gap capacitor of Ding is formed by the structure of the capacitance sensor 1 installed in the casing 2 together with the blade tip 4. See col. 4, lines 58-60 of Ding. See FIG. 5 of Ding.

That is, one skilled in the art would appreciate that Ding's gap sensor is expressly directed to measuring a blade clearance with respect to a casing and has nothing to do with a charge distribution on the electrically insulating surface of the rotor blades or guide vanes that forms an electric or magnetic field indicative of a level of wear or a defect that can arise in the electrically insulating surface, as set forth in the claimed invention. Strangman merely shows that it is known to use thermal barrier coatings on turbine engine components. Consequently, this secondary reference fails to remedy the fundamental deficiencies of Ding noted above in connection with the claimed invention. We will now proceed to discuss the Deegan reference.

Deegan recognizes that turbine engines and burners that use a hydrocarbon fuel, upon combustion with air (and as result of many chemical reactions), will produce ionic species in a soot resulting from the combustion process. That is, recognition of ionic species in the soot from the turbine is the physical principle of Deegan. See Deegan col. 1, lines 60-65. Accordingly, Deegan uses a soot measurement device (e.g., antenna) for detecting the very low cyclotronic and mechanically activated frequencies in the soot produced by the turbine. See col. 3, lines 6-9 of Deegan. Consequently, one skilled in the art would recognize that combining Deegan (detection of ionic species in the turbine's soot) with Ding and Strangman, as proposed by the Examiner, would change the principle of operation of Ding (gap capacitance measurement). That is, one of ordinary skill in the art will appreciate that ionic detection of species in the turbine's soot (Deegan) is a different principle than performing a gap capacitance measurement between a blade and a casing. Appellant respectfully refers to MPEP 2143.01(VI) that states that if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to

render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). Although not required by the applicable rules, appellant notes that the combination proposed by the Examiner is so incongruous that if one were to reverse the order of the combination, in this case, the principle of operation of Ding (gap capacitance measurement) would fundamentally change the principle of operation of Deegan (ionic species detection in the soot), further supporting that the teaching of the combined references is not sufficient to render the claims *prima facie* obvious. Appellant will discuss below a second alternative basis of traversal in connection with the Ding/Strangman/Deegan combination proposed by the Examiner to reject claims.

The Examiner states in the continuation sheet of Advisory Action dated 8/21/2008, lines 5-6 that Ding (col. 2 line 26) expressly operates in the kilohertz frequency range. Opposite to Ding (and to the claimed invention), Deegan expressly describes at col. 1, lines 52-54 that the radio receiver of his invention is tuned to the extremely low frequencies of such emissions. Each of the frequencies listed in Table 1 of Deegan is below 100 Hz. Accordingly, one skilled in the art would appreciate that Deegan, if anything, teaches away from a gap measuring sensor operating in a kilohertz frequency range. Thus, the Examiner further errs in proposing a combination of a reference (Deegan, where the ionic species detection expressly requires <100 Hz operation) that makes a prior art reference (Ding) inoperable for its intended purpose (gap sensor operation in the kilohertz frequency range). As stated by the CAFC in *Tec Air, Inc. v Denso Manufacturing Michigan Inc.* 192 F3d 1353, 52 USPQ2d 1294 (Fed Cir. 1999, a resulting inoperable prior art may be considered to teach away from the proposed combination. That is, not to teach the combination, thereby supporting a showing of nonobviousness. See also M.P.E.P. 2143.01(V) stating that if the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Although not required by the applicable rules, appellant notes that the combination proposed by the Examiner is so incongruous that if one were to reverse the order of the combination, an inoperable result would also occur. In this case, Deegan (that requires uses of a receiver tuned to low frequency operation (<100 Hz)) would be rendered inoperable for its intended purpose of ionic species detection if one were to operate in the kilohertz frequency

range (with the gap detector of Ding), further supporting that the teaching of the combined reference is not sufficient to render the claims *prima facie* obvious.

In view of the foregoing considerations, appellant respectfully asserts that independent claims 21 and 41 are not rendered obvious by the combination of Ding/Strangman/Deegan. Furthermore, claims 22-25 and 27-31 either directly or indirectly, depend from independent claim 21 and are therefore construed to contain each of the structural and/or operational relationships of claim 21. Thus, the applied combination fails to render obvious such dependent claims. Therefore, the Board is respectfully requested to withdraw the §103 rejections, under either basis of traversal.

Independent claim 32 is directed to a method for determining damage to an electrically insulating surface of a turbine component. Claim 32 in part recites creating an electric or magnetic field strength by a charge distribution on the electrically insulating surface of the turbine blade or vane. The electric or magnetic field strength is measured by a measuring element operating in a kilohertz frequency range. The strength of the electric or magnetic field is indicative of a level of wear or a defect that arises in the electrically insulating surface. In view of the discussion above, appellant asserts that based on the distinguishing structural and/or operational relationships respectively recited in claim 32, such a claim (and claims depending there from) are also not rendered obvious by the applied combination. Thus, for similar reasons, the applied combination of Ding/Strangman/Deegan fails to render obvious these dependent claims. Therefore, appellant respectfully requests the Board to withdraw these rejections.

B. *Regarding the rejection of claims 37-40 under 35 U.S.C. 103(a) as being unpatentable over Ding, Strangman, Deegan and further in view of I.E.E.E. Interharmonic Task Force Publication titled "Interharmonics in Power Systems.*

Dependent claims 37-40 are rejected under 35 USC § 103(a) as being unpatentable over Ding, Strangman, Deegan and further in view of I.E.E.E. Interharmonic Task Force Publication titled "*Interharmonics in Power Systems*". Appellant traverses and incorporates herein the remarks made above in response to the rejection of claims. Claims 37-40 include additional distinguishing features and are construed to contain the structural and/or operational

relationships of claim 32. In view of the discussion above that claim 32 is not rendered unpatentable by the Ding, Strangman and Deegan references, claims 37-40 are also not rendered unpatentable over such references. The I.E.E.E. Interharmonic Task Force Publication does not cure the fundamental deficiencies of the Ding, Strangman, Deegan references with respect to claim 32, and therefore further applying the I.E.E.E. Interharmonic Task Force Publication does not render obvious claims 37-40. Therefore, appellant respectfully requests the Board to withdraw these rejections.

8. CLAIMS APPENDIX - 37 CFR 41.37(c) (1) (viii).

A copy of the claims involved in this appeal is attached as a claims appendix under 37 CFR 41.37(c) (1) (viii).

9. EVIDENCE APPENDIX - 37 CFR 41.37(c) (1) (ix)

None is required under 37 CFR 41.37(c) (1) (ix).

10. RELATED PROCEEDINGS APPENDIX - 37 CFR 41.37(c) (1) (x)

None is required under 37 CFR 41.37(c) (1) (x).

Respectfully submitted,

Dated: 11/24/08

By: [signature]

John P. Musone
Registration No. 44,961
(407) 736-6449

Siemens Corporation
Intellectual Property Department
170 Wood Avenue South
Iselin, New Jersey 08830

APPENDIX OF CLAIMS ON APPEAL

21. A turbo engine, comprising:

a plurality of rotor blades made of an electrically conducting material having an electrically insulating surface and arranged on a rotor shaft that is rotatably mounted in a housing and electrically connected to a reference potential or a plurality of fixed guide vanes made of an electrically conducting material having an electrically insulating surface with the electrically conducting material of the guide vanes electrically connected to the reference potential;

a measuring element operating in a kilohertz frequency range for measuring an electric or magnetic field strength set up by a charge distribution on the electrically insulating surface of the rotor blades or guide vanes and for generating a signal indicative of the electric or magnetic field strength, wherein the strength of the electric or magnetic field is indicative of a level of wear or a defect that can arise in the electrically insulating surface;

wherein the measuring element is arranged near a radially disposed row of the rotor blades or near a radially disposed row of the guide vanes, and further wherein the frequency range is based on a rotational speed of the turbo engine and the number of rotor blades per row or the number of guide vanes per row; and

a monitoring unit for determining when the signal deviates from a threshold being defined responsive to at least one of a load condition of the turbo engine and a location of the rotor blades or the guide vanes relative to an outlet of the turbo engine.

22. The turbo engine as claimed in claim 21, wherein at least one measuring element is arranged on the rotor shaft in the region of the guide vanes.

23. The turbo engine as claimed in claim 22, wherein at least one measuring element is arranged in the region of the rotor blades and at least one measuring element is provided for measuring an electric or magnetic field strength set up by the first charge distribution on the surface of the rotor blades.

24. The turbo engine as claimed in claim 23, wherein at least one measuring element is formed by a coaxial antenna.

25. The turbo engine as claimed in claim 23, wherein at least one measuring element is connected to a measuring unit.

27. The turbo engine as claimed in claim 25, wherein the measuring unit has a communication link to a control center.

28. The turbo engine as claimed in claim 21, wherein the monitoring unit comprises a signaling or an alarm device.

29. The turbo engine as claimed claim 21, wherein the turbo engine is shut down by the monitoring unit.

30. The turbo engine as claimed in claim 23, wherein the electrically insulating surface is formed by a coating.

31. The turbo engine as claimed in claim 23, wherein the turbo engine is a gas turbine.

32. A method for determining damage to an electrically insulating surface of a turbine component, comprising:

providing a plurality of turbine blades or vanes made of an electrically conducting material and arranged within a turbo engine;

creating an electric or magnetic field strength by a charge distribution on the electrically insulating surface of the turbine blade or vane;

measuring the electric or magnetic field strength by a measuring element operating in a kilohertz frequency range, wherein the strength of the electric or magnetic field is indicative of a level of wear or a defect that can arise in the electrically insulating surface;

positioning the measuring element near a radially disposed row of the rotor blades or near a radially disposed row of the guide vanes, and wherein the frequency range is based on a rotational speed of the turbo engine and the number of rotor blades per row or the number of guide vanes per row;

defining a threshold responsive to at least one of a load condition of the turbo engine and a location of the rotor blades or the guide vanes relative to an outlet of the turbo engine; and

determining when the electric or magnetic field strength deviates from the threshold.

33. The method as claimed in claim 32, wherein the measuring element is arranged on a rotor shaft in the region of the vanes.

34. The method as claimed in claim 32, wherein the deviation is transmitted to a control center.

35. The method as claimed in claim 32, wherein an alarm is output when the threshold is exceeded.

36. The method as claimed in claim 32, wherein the turbo engine is shut down when the threshold is exceeded.

37. The method as claimed in claim 32, wherein a measurement signal supplied by the at least one measuring element is transformed by a Fourier transformation, by a measuring unit.

38. The method as claimed in claim 37, wherein a FFT transformation unit is used.

39. The method as claimed in claim 38, wherein a result of the transformation is displayed or signaled.

40. The method as claimed in claim 39, wherein the result of the transformation is compared with the threshold.

41. A turbo engine, comprising:

a plurality of rotor blades made of an electrically conducting material having an electrically insulating surface and arranged on a rotor shaft that is rotatably mounted in a housing and electrically connected to a reference potential or a plurality of fixed guide vanes made of an electrically conducting material having an electrically insulating surface with the electrically conducting material of the guide vanes electrically connected to the reference potential;

a measuring element operating in a kilohertz frequency range for measuring an electric or magnetic field strength set up by a charge distribution on the electrically insulating surface of the rotor blades or guide vanes and for generating a signal indicative of the electric or magnetic field strength, wherein the strength of the electric or magnetic field is indicative of a level of wear or a defect that can arise in the electrically insulating surface;

wherein the measuring element is arranged near a radially disposed row of the rotor blades or near a radially disposed row of the guide vanes, and wherein the frequency range is based on a rotational speed of the turbo engine and the number of rotor blades per row or the number of guide vanes per row; and

a monitoring unit for determining when the signal deviates from a threshold being defined responsive to a load condition of the turbo engine.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.